

A-CED Equations and Formulas

Alignments to Content Standards: A-CED.A.4

Task

Use inverse operations to solve the equations for the unknown variable, or for the designated variable if there is more than one. If there is more than one operation to “undo”, be sure to think carefully about the order in which you do them. For equations with multiple variables, it may help to first solve a version of the problem with numerical values substituted in.

a. $5 = a - 3$

b. $A - B = C$ (solve for A)

c. $6 = -2x$

d. $IR = V$ (solve for R)

e. $\frac{x}{5} = 3$

f. $W = \frac{A}{L}$ (solve for A)

g. $7x + 3 = 10$

h. $ax + c = R$ (solve for x)

i. $13 = 15 - 4x$

j. $2h = w - 3p$ (solve for p)

k. $F = \frac{GMm}{r^2}$ (solve for G)

IM Commentary

The first 7 problems are pretty easy for students, but they are an important lead-in to part h. When students first encounter a problem like the one shown in part h, many try to simply write the answer down without following the same process as they do in other equations, giving them answers like $x = \frac{R}{a+c}$ or $x = \frac{R}{a} - C$

Also, it never hurts to mention when equations that students run across are of physical significance: Part D is Ohm's Law, relating the current I that flows through a conductive material (of resistance R) to the voltage V between the two ends. Part K is Newton's law of universal gravitation, describing the strength of the force between two objects of masses M and m which are r units apart. The known value of Newton's gravitational constant G , namely $G \approx 6.673 \times 10^{-11} \frac{\text{m}^3}{\text{kg} \cdot \text{s}^2}$, comes precisely from measuring the force, mass, and distance between various objects, and then solving the equation in K for G !

[Edit this solution](#)

Solution

a. $5 = a - 3$

Addition is the inverse of subtraction, so add 3 to both sides: $a = 8$

b. $A - B = C$ (solve for A)

This equation has the same structure as the previous one. Addition is the inverse of subtraction, so add B to both sides: $A = C + B$.

c. $6 = -2x$

Division is the inverse of multiplication, so divide both sides by -2: $x = -3$.

d. $IR = V$ (solve for R)

This equation has the same structure as the previous one. Division is the inverse of

multiplication, so divide both sides by I : $R = \frac{V}{I}$

e. $\frac{x}{5} = 3$

Multiplication is the inverse of division, so multiply both sides by 5: $x = 15$.

f. $W = \frac{A}{L}$ (solve for A)

This equation has the same structure as the previous one. Multiplication is the inverse of division, so multiply both sides by L : $A = wL$.

g. $7x + 3 = 10$

This equation involves multiplication and addition. If we were evaluating for x , the order of operations dictates that we would multiply and then add. To undo these operations, it is easiest to cancel them in the opposite order. (Otherwise we run into issues with distribution.) Thus, we first subtract 3 from both sides and then divide by 7: $x = 1$.

h. $ax + c = R$ (solve for x)

This equation has the same structure as the previous one. To undo the multiplication and addition, we first subtract c from both sides and then divide by a : $x = \frac{R-c}{a}$

i. $13 = 15 - 4x$

This equation has multiplication and subtraction. Order of operations dictate that we would evaluate this equation for a given x by first multiplying by -4 and then adding 15, so we will do the inverses in the opposite order. First subtract 15 from both sides, and then divide both sides by -4 , to get $x = \frac{13-15}{-4} = \frac{1}{2}$.

j. $2h = w - 3p$ (solve for p)

This equation has the same structure as the previous one. First subtract w from both sides, and then divide by -3 to get $p = \frac{2h-w}{-3} = \frac{w-2h}{3}$.

k. $F = \frac{GMm}{r^2}$ (solve for G)

First multiply both sides by r^2 , then divide both sides by Mm , resulting in $G = \frac{Fr^2}{Mm}$. To

create an equation in the same form, simply replace the variables other than G with numbers. For example, the equation $10 = \frac{7x}{3}$ is in the same form. We would solve this by multiplying by 3 and dividing by 7, giving $x = \frac{30}{7}$.



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